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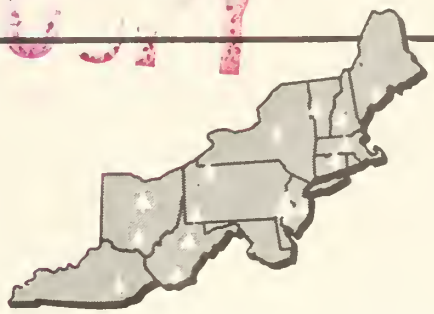

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WEIGHT / VOLUME RATIOS FOR APPALACHIAN HARDWOODS

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Abstract.—Weight / volume relationships are presented in both English and metric systems for 15 commercial species of Appalachian hardwoods. Two ratios are presented: weight of wood volume alone, and weight of wood plus bark.

KEY WORDS: Wood weight, weight-volume ratios, Appalachian hardwoods.

Buyers and sellers of forest products sometimes need information about the relationship between total wood volume and weight. Consider the increased use of weight-scaling as a marketing practice. Present methods may give a fairly reliable estimate of board-foot volume for a given weight. But what about estimates of chips, sawdust, and bark? All these products now have actual or potential merchantability. Therefore, it is logical that we develop and use ratios of weight to total volume.

Tables showing the relationship between wood weight and volume have been published.[1] However, these data are based on the weight and volume of a 2- by 2-inch (50.8– × 50.8-mm) clear specimen from the top 4 feet (1.22 m) of 16-foot (4.88-m) butt logs of typical trees. We believe that figures showing the association between total log volume and log weight (with bark) would be much more useful.

For this reason, we developed tables of weight / volume ratios for the most common species of Appalachian hardwoods. The data for the report came from logs harvested in western Maryland, West Virginia, and southwestern Virginia. The period of log weighing and measuring ran from early March to late November.

The calculations are based on unbarked logs 8 to 16 feet (2.44 to 4.88 mm) long (table 1). The logs were from trees severed from the stump less than 2 weeks before weighing and measuring. The weight per unit of volume for

[1] USDA Forest Service, Forest Products Laboratory. 1958. Weights of various woods grown in the United States. For. Prod. Lab. Tech. Note 218. 8 p. (Reissued; latest revision in 1953.)

each log was determined by dividing the individual log weight by its volume as derived by Smalian's formula. Measurements were taken both inside and outside bark to establish log volume of wood only and log volume of wood plus bark.

For each species sampled, tables 2 and 3 list the average weight per volume in English and metric units, along with the 95-percent confidence intervals. If you are interested in the association between log weight and *wood* volume, use table 2. If you want to find the ratio between log weight and total volume of *wood plus bark*, use table 3.

Table 1.—Number of and weight range of logs used in construction of weight tables

Species	Logs	Individual weight range
	No.	*Lbs.*
Ash, white (*Fraxinus americana*)	164	160 → 2,120
Basswood (*Tilia americana*)	378	180 → 2,960
Beech (*Fagus grandifolia*)	196	460 → 3,610
Birch, black (*Betula lenta*)	68	330 → 3,510
Blackgum (*Nyssa silvatica*)	74	490 → 4,190
Cherry, black (*Prunus serotina*)	227	200 → 2,760
Cucumbertree (*Magnolia acuminata*)	199	220 → 1,720
Hickory (*Carya* sp.)	406	400 → 5,750
Locust, black (*Robinia pseudoacacia*)	79	170 → 1,330
Maple, red (*Acer rubrum*)	90	290 → 3,040
Maple, sugar (*Acer saccharium*)	264	290 → 4,730
Oak, chestnut (*Quercus montana*)	313	280 → 3,390
Oak, red (*Quercus borealis*)	1,366	270 → 6,440
Oak, white (*Quercus alba*)	209	320 → 4,170
Yellow-poplar (*Liriodendron tulipifera*)	477	270 → 2,860

Table 2.—Weight / volume ratios for Appalachian hardwood sawlogs

[Volume based on *inside* bark measurements[a]]

Species	Lbs./ft.^{3}	Coeff. of var. (%)	Kg./m^3
Ash, white	54 ± 2[b]	23.7	859 ± 31[b]
Basswood	53 ± 1	21.3	846 ± 18
Beech	64 ± 1	15.9	1,019 ± 23
Birch, black	67 ± 4	21.3	1,070 ± 55
Blackgum	66 ± 3	19.5	1,057 ± 48
Cherry, black	53 ± 1	14.7	855 ± 16
Cucumbertree	51 ± 2	22.5	822 ± 26
Hickory	67 ± 1	20.4	1,072 ± 21
Locust, black	59 ± 3	25.8	939 ± 55
Maple, red	57 ± 3	22.9	910 ± 44
Maple, sugar	62 ± 2	22.5	985 ± 27
Oak, chestnut	69 ± 1	18.1	1,108 ± 22
Oak, red	67 ± 1	18.8	1,076 ± 11
Oak, white	64 ± 2	19.8	1,030 ± 28
Yellow-poplar	57 ± 1	21.3	911 ± 17

[a] Weight based on unbarked logs (wood and bark).
[b] + and − values = 95% confidence interval.

Table 3.—Weight / volume ratios for Appalachian hardwood sawlogs

[Volume based on *outside* bark measurements]

Species	Lbs./ft.^{3}	Coeff. of var. (%)	Kg./m^3
Ash, white	46 ± 2[a]	21.3	745 ± 5[a]
Basswood	47 ± 1	20.2	746 ± 15
Beech	60 ± 1	15.4	960 ± 21
Birch, black	59 ± 4	21.2	950 ± 49
Blackgum	56 ± 3	19.0	892 ± 39
Cherry, black	51 ± 1	14.4	814 ± 15
Cucumbertree	46 ± 1	21.6	734 ± 22
Hickory	59 ± 1	18.5	942 ± 17
Locust, black	44 ± 2	20.6	706 ± 33
Maple, red	53 ± 2	20.3	846 ± 36
Maple, sugar	55 ± 1	20.8	887 ± 22
Oak, chestnut	59 ± 1	16.4	948 ± 17
Oak, red	59 ± 1	16.7	945 ± 8
Oak, white	57 ± 1	17.4	919 ± 22
Yellow-poplar	59 ± 1	19.4	787 ± 14

[a] + and − values = 95% confidence interval.

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